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THESIS

AN ANALYSIS OF DEPOT MAINTENANCE
ANNUAL REPORTS

by

Roger Dale Takalo

March 1986

Thesis Co-Advisors:

Shahid L. Ansari
Ken J. Euske

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An Analysis of
Depot Maintenance Annual Reports

by

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Lieutenant Commander, United States Navy
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Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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March 1986

ABSTRACT

The objective of this thesis is to develop a feedback mechanism for the Department of Defense depot maintenance data tape submission process to the Office of the Assistant Secretary of Defense (Acquisitions and Logistics), (A&L). Several methods of data analysis, such as use of data tables, cost statements, trends, charts, ratios, and percentages are presented. These analysis methods are then combined to develop possible reports that could be sent to various levels of users, both in the Department of Defense and external to the Department of Defense. It is recommended that four separate reports be generated for the user groups and an annual report that can be used as a general report of the DOD depot maintenance system.

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I. INTRODUCTION

A. THESIS OBJECTIVE

The purpose of this research project is the development of a feedback mechanism for information contained on the Department of Defense (DoD) depot maintenance data tape submissions. Feedback would be provided to the maintenance depots and other interested groups. The Office of the Assistant Secretary of Defense (Acquisitions and Logistics), OASD(A&L), has an interest in developing such a feedback or reporting system. This thesis is an attempt to assist in that endeavor. The development of the reports to provide the feedback entailed a review of financial and accounting literature to help identify meaningful information for the user of the reports.

B. A UNIFORM COST ACCOUNTING SYSTEM--HISTORY OF THE 7220.29-H

As early as 1963, the Department of Defense attempted to establish a cost accounting and reporting system which would apply to the depot level maintenance activities of all the services. In 1963 DoD Instruction 7220.14, "Uniform Cost Accounting for Depot Maintenance" and DoD Instruction 7220.9, "Depot Maintenance" were issued. The two systems established by these directives were combined in 1968 and a single directive, DoD Instruction 7220.29, "Guidance for Cost Accounting and Reporting for Depot Maintenance and Maintenance Support"

was issued. The system was to be implemented in October 1976.

The objectives of the system were stated as follows:

1. To establish a uniform cost accounting system for use in accumulating the costs of depot maintenance activities as they relate to the weapon systems supported for items maintained. This information would enable managers to compare unit repair costs with replacement cost.
2. To assure uniform recording, accumulating and reporting on depot maintenance operations and maintenance support activities so that comparison of repair costs can be made between depots and between depots and contract sources performing similar maintenance functions.
3. To assist in measuring productivity, developing performance and cost standards and determining areas for management emphasis, which would enable managers to evaluate depot maintenance and maintenance support activities for efficient resource use.
4. To provide a means of identifying maintenance capability and duplication of capacity and indicating both actual and potential areas for interservice support of maintenance workload.

The reporting requirements of the 7220.29-H include an annual tape submission to the Assistant Secretary of Defense (A&L) by each DoD component. These tape submissions are combined in a data base at the Defense Data Maintenance Center in Washington, D.C. The data are output into fourteen summary tables which are described in the Appendix of this thesis.

C. THESIS ORGANIZATION

This thesis is divided into four chapters. The first chapter covers preliminary material. The second chapter explores various methods of data presentation in financial tables and statement of costs. The third chapter develops

ratios, percentages, and trends as vehicles of analysis of depot maintenance. The final chapter presents a discussion of the reporting possibilities and the conclusions and recommendations.

D. RESULTS

It is recommended that four reports be developed from the 7220.29-H data. The four reports would augment data already being provided to the various user groups. Specific reports recommended include: a report for the management of the maintenance depots; a report for military service headquarters and DoD staff; a report for government organizations external to DoD; and a general annual report. These reports contain data that describe, at various levels of detail, the activities of the depots.

II. TABLES AND STATEMENTS OF COSTS

A. INTRODUCTION

Military Service Depots annually submit data on completed job orders to the Department of Defense (DoD), as directed by DoD Instruction 7220.29-H. The data, submitted on magnetic tapes, contains 50 items. [Ref. 1:App. B] The Defense Manpower Data Center produces, on request, 14 different "table reports" from these data. Though the reports, described in the Appendix, are currently used by the Directorate for Maintenance Policy, OASD(A&L), the tables are not in a format that would be most useful to other potential users of the 7220.29-H data.

It is the objective in this chapter to present several proposed data display formats (tables) that, when used in conjunction with others, would organize the data into standardized report formats for various levels of users. The initial thesis objective was to develop a single annual report of the depot system similar to the annual financial reports made to stockholders. However, detailed analysis of user requirements indicated a need for different report formats for different groups of users.

The purpose of 7220.29-H is to report cost and production information. The cost and production information contained on the magnetic tape submission is identified in Table 2-1.

TABLE 2-1
LABOR COST DATA SUBMITTED

FIELD	LABOR HOUR AND COST DATA
	<u>Direct Civilian Labor</u>
	Production
17	cost
18	hours
	Other
19	cost
20	hours
	<u>Direct Military Labor</u>
	Production
21	cost
22	hours
	Other
23	cost
24	hours
	<u>Direct Material Cost</u>
25	Funded
	Unfunded
26	Investment items at full price
27	Exchanges
28	Modification kits
29	Expenses
	<u>Other Direct</u>
30	Funded
31	Unfunded
	<u>Operations Overhead</u>
32	Funded
33	Unfunded

TABLE 2-1 (CONT'D)

	<u>General and Administrative Expenses</u>
34	Funded
35	Unfunded
36	Contract/Interservice/Non-Depot Maintenance
	<u>Government-Furnished Materials</u>
37	Investment Items at Full Price
38	Exchanges
39	Modification kits
40	Expense
	<u>Government-Furnished Services</u>
41	Funded
42	Unfunded
	<u>Maintenance Support Costs Organic</u>
43	Funded
44	Unfunded
	<u>Production Data</u>
45	Total Production Quantity Completed
46	Unused
	<u>Quantity of Completed Items Inducted</u>
47	During Reporting Year
48	During Year Proceeding Year
49	During All Other Previous Years
50	Work Days in Progress

The other tables presented herein suggest alternate ways to compile and present the available data.

B. DEPOT MAINTENANCE COST AND LABOR HOURS STATEMENT

1. Description

The proposed Depot Maintenance Cost and Labor Hours statement, described in Table 2-2, combines cost and labor data from the 7220.29-H data tape.

2. Uses

The Depot Maintenance Costs and Labor Hour statement can assist in the control of costs. It can provide information needed for planning or assessing a depot's ability to meet objectives and for focusing attention on nonrecurrent or unforeseen problems that may arise. It is modeled after portions of standard financial statements and is most similar to the profit and loss statement used in private sector financial reports.

Presenting the data in this format enables the observer to see cost by category during the reported period. Costs can be extracted from various categories and used for further analysis of a service's depots. Ratios and trend analysis from these tables are presented in Chapter III of this thesis.

An alternative method of presenting these cost data is by the different types of commodities repaired. Presenting data by commodity type costs gives a clear picture of total

TABLE 2-2

DEPOT MAINTENANCE COSTS AND LABOR HOUR STATEMENT

DIRECT COSTS	xxxxx	<u>1/</u>
TOTAL OVERHEAD COSTS	xxxxx	<u>2/</u>
NON-ORGANIC MAINTENANCE COSTS (from field 36 of 7220.29-H data)	xxxxx	
GOVERNMENT-FURNISHED MATERIALS	xxxxx	<u>3/</u>
GOVERNMENT-FURNISHED SERVICES	xxxxx	<u>4/</u>
MAINTENANCE SUPPORT COSTS	<u>xxxxx</u>	<u>5/</u>
TOTAL COSTS	XXXXXX	
Direct Civilian Labor Hours:		
Production (from field 18)	xxxxx	
Other (from field 20)	xxxxx	XXXXXX
Direct Military Labor Hours:		
Production (from field 22)	xxxxx	
Other (from field 24)	xxxxx	XXXXXX
Total		XXXXXX

Work Days in Progress (from field 50)

NOTES: Total of 7220.29-H tape fields:

- 1/ 17, 19, 21, 23 (Production and other costs/direct labor (Civilian and Military)) and 25 through 31 (all direct material costs and other direct costs)
- 2/ 32 through 35, summation of all Operations and General and Administrative Overhead. Parker (1984) found that total overhead is more comparable across Services than either production indirect of G&A [Ref. 2-1]
- 3/ 37 through 40
- 4/ Fields 41 and 42
- 5/ Fields 43 and 44

commodity cost by items. However, a more comprehensive view is given by the categories presented in Table 2-2.

C. TOTAL COST BY FACILITY TYPE

1. Description

The proposed Total Cost by Facility Type statement, as shown by Table 2-3, identifies all costs separated into funded, unfunded and total costs and displays Department or Service costs divided among the four types of facilities or functions.

TABLE 2-3
TOTAL COST BY FACILITY TYPE

<u>FACILITY TYPE</u>	<u>FUNDED</u>	<u>UNFUNDED</u>	<u>TOTAL</u>
DEPOT MAINTENANCE (1)	xxxx	xxxx	XXXX
NON-DEPOT MAINTENANCE (2)	xxxx	xxxx	XXXX
CONTRACT (3)	xxxx	xxxx	XXXX
INTERSERVICE (4)	<u>xxxx</u>	<u>xxxx</u>	<u>XXXX</u>
TOTAL	xxxx	xxxx	XXXX

2. Uses

The proposed Total Cost by Facility Type statement provides information to track how much a service or depot is using of its own resources for depot maintenance and how much use is being made of non-depot, interservicing, or contractor maintenance. Interservice and contracting costs are

particularly important because they help to identify the cost of alternate repair capacity.

Note that Table 2-3, "Total Cost by Facility Type," is similar to Table 3 in the standard report from OASD(A&L). However, commodity types have been omitted so that the table is less "busy."

D. COST BREAKDOWN BY ORGANIC DEPOT MAINTENANCE ACTIVITY

Organic maintenance is that maintenance performed by a military department under military control utilizing government-owned or controlled facilities, tools, test equipment, spares, repair parts, and military or civilian personnel. (DoD Inst 4151.16) [Ref. 2-2:p. C-1]

1. Description

The proposed Select Cost by Activity Type statement, Table 2-4, displays labor hours and costs associated with organic depot maintenance. The report would list activities in the first column while the remaining columns present the costs and hours used in organic maintenance production. The activities will normally be depots, but totals of depots by Service could be calculated to provide total service data.

TABLE 2-4

SELECT COSTS BY ACTIVITY TYPE

ACTIVITY	LABOR HOURS	DIRECT COSTS	MAINTENANCE SUPPORT COST	OVERHEAD COSTS	TOTAL COSTS
XXXXXXXX	XXXX	XXXX	XXXXX	XXXXX	XXXX
<u>XXXXXXXX</u>	<u>XXXX</u>	<u>XXXX</u>	<u>XXXXX</u>	<u>XXXXX</u>	<u>XXXX</u>
TOTAL	XXXX	XXXX	XXXXX	XXXXXX	XXXXX

2. Uses

The cost and labor hour comparisons would show which depots have varying costs within categories relative to other activities. This tabular comparison, however, cannot be used for depot performance evaluation because depot size or workload differences prevent equitable comparisons. This report could be used for growth comparisons relative to other depots growth if previous period reports are consulted.

This statement does not directly display contract, interservice and non-depot costs categories as they are displayed in the Total Cost by Facility Type statement, Table 2-3. These costs, however, are distributed in the various cost categories and are included in the total cost column. The statement does provide users the cost structure of each organic depot activity within the Service. It can be used to select various costs to be compared, such as a ratio to labor hours, total cost or other costs. Additionally, it can be used to compare variances in depots within the Service and with other Services.

The Select Costs by Activity Type breakdown in Table 2-4 is an adaptation of a report currently compiled by the personnel at OASD(A&L).

E. TOTAL COST BY COMMODITY GROUP

1. Description

The proposed Total Cost by Commodity Group statement, Table 2-5, identifies total costs by facility type (organic,

TABLE 2-5
TOTAL COST BY COMMODITY GROUP

COMMODITY GROUP	ORGANIC	CONTRACT	INTERSERVICE	TOTAL
AIRCRAFT	xxxx	xxxxx	xxxxx	XXXXX
A/C ENG.	xxxx	xxxxx	xxxxx	XXXXX
COMBAT VEHC.	xxxxx	xxxxx	xxxxx	XXXXX
CONSTRUCTION EQ.	xxxxx	xxxxx	xxxxx	XXXXX
COMM/ELEC	xxxxx	xxxxx	xxxxx	XXXXX
MISSILES	xxxxx	xxxxx	xxxxx	XXXXX
SHIPS	xxxxx	xxxxx	xxxxx	XXXXX
WEAPON/ MUNITIONS	xxxxx	xxxxx	xxxxx	XXXXX
GENERAL	xxxxx	xxxxx	xxxxx	XXXXX
<u>OTHER</u>	<u>xxxxx</u>	<u>xxxxx</u>	<u>xxxxx</u>	<u>XXXXX</u>
TOTAL	XXXXX	XXXXX	XXXXX	XXXXX

contract, and interservice). This statement provides management information on how these costs are allotted within each major commodity group. The report does not indicate when a small item is beginning to increase in cost because this information would be included in commodity totals.

2. Uses

This statement presents data so comparisons can be made among commodity groups by facility type costs. For example, costs of organic maintenance can be compared to costs

for interservice or contract maintenance on any one particular commodity group. Over time, commodity groups can be tracked by management to see how costs vary.

Another way of presenting this table is to select a limited number of the higher cost commodities for display for each of the services. This would preclude having commodity groups with little or zero costs when the depots do not repair certain commodities.

F. ORGANIC COSTS BY COMMODITY GROUP AND SERVICE

1. Description

The proposed Total Organic Costs by Commodity Group statement, Table 2-6, identifies costs at individual organic depots. This statement provides management information on how these costs are allocated to the depots various major commodity groups.

Organic costs by commodity group and service, Table 2-6, reports on select organic depots by service. Individual displays can separate depots into specialty areas such as Air Logistics Centers, Army Depots, Naval Air Rework Facilities, or Naval Shipyards.

2. Uses

As with Table 2-5, Table 2-6 can also be used to display a limited number of the higher cost commodity groups for comparison. Additionally, numbers of units of the commodities could be included with the cost or as a separate table with units rather than cost.

TABLE 2-6

TOTAL ORGANIC COSTS BY COMMODITY GROUP

COMMODITY GROUP	ALAMEDA	CHERRY PT.	JAX	N. ISLAND	PENSACOLA
AIRCRAFT	XXXX	XXXX	XXXX	XXXXX	XXXXX
A/C ENG.	XXXX	XXXX	XXXX	XXXXX	XXXXX
COMBAT VEHC.	XXXX	XXXX	XXXX	XXXXX	XXXXX
CONST. EQ.	XXXX	XXXX	XXXX	XXXXX	XXXXX
COMM/ELEC	XXXX	XXXX	XXXX	XXXXX	XXXXX
MISSILES	XXXX	XXXX	XXXX	XXXXX	XXXXX
SHIPS	XXXX	XXXX	XXXX	XXXXX	XXXXX
WPNS/MUN.	XXXX	XXXX	XXXX	XXXXX	XXXXX
GENERAL	XXXX	XXXX	XXXX	XXXXX	XXXXX
<u>OTHER</u>	<u>XXXX</u>	<u>XXXX</u>	<u>XXXX</u>	<u>XXXXX</u>	<u>XXXXX</u>
TOTAL	XXXX	XXXX	XXXX	XXXXX	XXXXX

Comparisons among depot costs by commodity could indicate differences in efficiency in commodity areas for the depots. Such comparisons could also reveal depots where specific commodity items might be funneled for better cost control. One depot might be more efficient at repair of engines while another is more adept in the repair of missiles. However, it must be remembered that the data in the tables are only indicators. Additional and more detailed investigation would be necessary before any resource allocation decisions were made.

G. CONTRACT COSTS BY COMMODITY GROUP FOR SELECT DEPOTS

1. Description

This proposed statement, Contract Costs by Commodity Group, Table 2-7, is similar in format to the Organic Costs by Commodity Group, Table 2-6. The difference being only contracting costs are considered in Table 2-7. This table describes the contract maintenance costs for repairable items at various depots. As is the case in the Total Organic Costs by Commodity Group, this table lists only major items and not components. A major commodity group could mask abnormal variations in a small component contractor's costs and might not be noticable. However, this type of cost variation would be visible at the depot management level.

2. Uses

Comparisons of Tables 2-6 and 2-7 would provide management with indications of where interservicing might take the place of contracting for certain commodities. For instance, a decreasing dollar volume of work indicated in Table 2-6 could indicate potential capacity for a contracted commodity in Table 2-7. As with organic costs by commodity group, the Contract Costs by Commodity Group table would also list numbers of commodity items contracted or the items could be listed as a separate table.

TABLE 2-7

CONTRACT COST BY COMMODITY GROUP

COMMODITY GROUP.	ALAMEDA	CHERRY PT.	JAX	N. ISLAND	PENSACOLA
AIRCRAFT	XXXX	XXXX	XXXX	XXXXX	XXXXX
A/C ENG.	XXXX	XXXX	XXXX	XXXXX	XXXXX
COMBAT VEHC.	XXXX	XXXX	XXXX	XXXXX	XXXXX
CONST. EQ.	XXXX	XXXX	XXXX	XXXXX	XXXXX
COMM/ELEC	XXXX	XXXX	XXXX	XXXXX	XXXXX
MISSILES	XXXX	XXXX	XXXX	XXXXX	XXXXX
SHIPS	XXXX	XXXX	XXXX	XXXXX	XXXXX
WPNS/MUN.	XXXX	XXXX	XXXX	XXXXX	XXXXX
GENERAL	XXXX	XXXX	XXXX	XXXXX	XXXXX
<u>OTHER</u>	<u>XXXX</u>	<u>XXXX</u>	<u>XXXX</u>	<u>XXXXX</u>	<u>XXXXX</u>
TOTAL	XXXX	XXXX	XXXX	XXXXX	XXXXX

H. COMMODITY MAINTENANCE AND MAINTENANCE SUPPORT COSTS

1. Description

The proposed Commodity Maintenance and Maintenance Support Costs statement, Table 2-8, describes the yearly cost of maintenance and support costs for each major commodity group. The table consists of the commodity groups list and the cost to repair each commodity per year for the last five years. The total maintenance costs for each year are listed at the bottom of the table.

TABLE 2-8

COMMODITY MAINTENANCE AND MAINTENANCE SUPPORT

COMMODITY GROUP	YEAR 5	YEAR 4	YEAR 3	YEAR 2	YEAR 1
Aircraft	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Comb. Veh.	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Ships	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX
<u>Etc.</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>
TOTAL	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

2. Uses

This data table indicates how commodity costs change over time. However, the table would not be usable for comparisons between service depots as cost variances exist due to local accounting practices and the normal mix of depot workloads.

This table could also be created for DoD as a whole, listing each depot or depot groups (i.e., Naval Air Rework Facilities or Air Logistics Centers). Relative comparisons of commodity costs over a yearly period could be made by the individual depots, realizing that the comparison cannot be used as an evaluation of performance. DoD could track the trend of various commodities and if an unusual increase or decrease is detected, further investigation would be warranted.

I. SUMMARY

This chapter has considered several alternative methods of presenting the 7220.29-H data. Its primary focus has been on raw cost data for the various facilities. Some formats for this data and its possible uses were identified. Table 2-2 presents the data in financial statement form. This table, the Depot Maintenance Costs Statement, was then used as a basis for development of the tables which followed it. OASD(A&L) guidance and users requirements were considered before deciding upon the tables presented in this chapter.

III. RATIO AND TREND ANALYSIS

A. INTRODUCTION

Some amounts on financial statements, such as net income, are highly significant in and of themselves; however, the significance of many amounts is highlighted by their relationship to other amounts. These significant relationships can be pinpointed and isolated effectively in many instances through the use of the analytical tools, ratio or percentage analysis. Two aspects of ratio analysis are relationships within one period and relationships between periods.

There is no particular list of ratios or percentages that can be identified as appropriate to all situations. Each situation will usually have a need for particular ratios. [Ref. 4:pp. 635-637]

Data tables are useful and necessary to determine actual cost data but to be able to analyze performance, the data must be manipulated so that the significance of the data can be evaluated. The manipulation enables comparisons and compact numerical descriptions of how the entity is performing. To this end, ratios, averages and trends are compiled from the tables of data to describe certain performance characteristics. These are useful tools for analysis because they conveniently summarize data in a form which is more easily understood, interpreted, and compared. These ratios can then be viewed at a glance and compared with standards of performance to give a snapshot of the depot status.

This chapter is divided into three main parts describing various techniques that can be used to depict depot maintenance performance. Covered first are three ratio comparisons

of depot performance. Next, six percentages are discussed, five of which are used to produce a pie chart that separates total cost into useful major divisions. Finally, trends and performance statistics are described and used to develop tables and graphs. Table 3-1 highlights the ratios discussed in this section.

B. RATIO ANALYSIS

1. Ratios

The ratio is a commonly used statistical yardstick that provides a measure of the relationship between two figures. In financial analysis, this relationship may be expressed as a rate (the change in costs per dollar of gross sales), as a percent at a particular time (cost of sales representing a designated percentage of gross sales), or as a quotient (current assets as a certain number of times the current liabilities). Of these forms, the percentage is the most popular. [Ref. 5:p. 192]

Data items in the tables of Chapter II may be difficult or even awkward for interpretation. For example, production performance may be difficult to assess by looking at the number of direct labor hours alone. However, comparing direct costs to direct labor hours required for production provides useful information to a decision maker who wishes to understand the depot maintenance system. This section develops ratios and percentages for analysis of depot maintenance and describes their use.

a. Direct Costs/Total Labor Hours

Direct costs per total labor hour is a ratio that relates direct cost (direct labor, direct materials, and other

TABLE 3-1
SUMMARY OF RATIOS

<u>RATIOS</u>	<u>USES: WHAT IT TELLS</u>	<u>DATA FIELDS</u>
1. DIR. COST/ LABOR HRS.	An indication of production performance	DIR. COST--17,19,21, 23,25,26,27,28,29,30, 31 LABOR HRS.--18,20,22, 24
2. OVHD/DIR COSTS	Monitor size of OVHD costs as a function of DIR. COST	OVHD--32,33,34,35 DIR. COST--"as shown above"
3. DIR. COST/ WORK DAYS IN PROCS. (WDIP)	Production cost per work day	DIR. COST--"as shown above" WDIP--50
4. DIR. COST/ TOTAL COST (TC)	Proportion of Total cost that is Direct cost	DIR. COSTS--"as above" TC--17,19,21,23,25 through 44
5. OVHD/TC	Proportion of Total cost that is OVHD dollars	OVHD--"as in above" DIR. COSTS--"as in above"
6. NON-ORGANIC COSTS/TC	Proportion of Total cost dollars that is Non-Depot, Contract, or Inter-Service costs	N.C.I.--36 TC--"as in above"
7. GOVT. FUR. MTLS. & SUP/ TC	Cost for con- tracting, inter- service, and non-depot main- tenance to total cost	GOVT. FUR. MTLs. & SUPP--37 through 40, 43,44 TC--"as in above"
8. SERVICE COSTS/ TC of DOD DEPOTS	Service's cost to DOD Depot Total Cost	Service TC, i.e., Army, Navy, Air Force, etc., to TC DOD DEPOT

direct) to total labor hours. Direct cost per labor hour provides a measure of production performance for the period in terms of labor hour costs to perform maintenance. This is an average cost measure and being such does not provide period costs or labor cost for a particular end item. However, overall averages can be useful in developing broad estimates of costs across depots. Direct cost per total labor hour is derived from the 7220.29-H data tape fields as described in Table 3-1. This measure of production has the advantage of being calculated directly from the 7220.29-H data tapes. Additionally, the Depot Maintenance Costs Statement, Table 2-2, and the ratio can be readily compared.

Alternatives to this ratio were considered such as cost per direct labor hour but additional data would be required to generate them such as data on work measurement standards.

b. Total Overhead/Direct Costs

Total overhead costs as a function of direct costs is a ratio that relates direct costs to the total overhead (i.e., production indirect, general and administrative costs). Parker [Ref. 6] found that total overhead is likely to be more compatible across services than either production indirect or G&A. The total overhead/direct costs ratio is a measure of the contribution of total overhead dollars for each direct cost dollar. The ratio is therefore a means to

monitor the size of the overhead costs as a function of direct costs.

The total overhead to direct costs ratio was developed to enable management to obtain an overall perspective of operations. This measure is relatively easy to develop from the data tapes. Direct costs are a combination of direct labor, materials and other as described in Section B.1.a, "Direct Costs/Total Labor Hours." As stated above, total overhead is the sum of both operations overhead (production indirect costs) and general and administrative expenses. Table 3-1 describes this ratio and the fields associated in the 7220.29-H tapes.

c. Direct Costs/Work Days in Process

Direct costs per work days in process (WDIP) is a measure of the production cost per processing work day. This ratio is a measure of daily in process production costs. It is an average cost figure for all production as a whole but cannot be used to develop production costs for individual commodity items. The ratios "dollars per day" value can be used as a comparison with previous or current years within a depot. Table 3-1 describes the data fields used to develop this ratio. Other costs per workday in process were considered but the most logical choice appeared to be the direct cost value because it represents the cost of the depots production effort. [Ref. 7:p. 110-1][Ref. 8:p. 192]

2. Percentages

As discussed in the previous section, ratios and percentages are the most popular form of financial analysis. This is true because of the ease with which one can view a portion of data in relation to the whole. [Ref. 8:p. 192] This section describes several percentages that relate to the total cost, the goal being to develop figures that provide summaries of the data. Given this goal of developing pictorial summaries, total cost was divided into major categories. These categories were selected from the Depot Maintenance Cost and Labor Hour Statement, Table 2-2. The resultant categories are direct costs, total overhead costs, non-organic maintenance costs, and Government-furnished materials and support costs. The additional percentage, Service Costs to Total Costs of DoD Depots, was developed so that each service's total depot costs could be used in the development of a second visual summary.

a. Direct Cost/Total Cost

Direct cost to total cost is a ratio that relates direct cost (direct labor, direct materials, and other direct) to the depot's total cost. This percentage provides a measure of production financing for the period in terms of total cost dollars. Direct cost to total cost is an average cost measure and does not provide period costs for an end item.

Management could use the direct cost to total cost percentage to determine shifts in relative size of the

production direct cost component when compared to the total cost common base. At a glance, management can gauge the relative significance of direct costs to total costs. This measure can be used to determine the growth or shrinkage of direct costs and their comparative importance to the total depot costs. Table 3-1 describes the 7220.29-H data tape fields used in this percentage calculation.

b. Total Overhead/Total Cost

Total overhead to total cost is a measure of the dollar value of total overhead (production indirect and G&A) generated per total cost dollar. Total overhead to total costs describes what part of the total cost dollar is made up of total overhead. Total overhead, as a percentage of other categories, does not appear to contribute to the breakdown of the major total cost picture. Therefore, this percentage calculation was selected as the way to depict the summary of internal production operations.

As with all the previous ratios, this percentage was developed to enable management to view operations at a glance with a pictorial summary. By expressing total overhead as a percentage of the total cost base, shifts in the relative size of total overhead can be compared to other costs and the significance of the costs can be evaluated. If presented as a total cost pie chart, a sense of cost relationships can be realized. Considered in this light, previous total overhead to total costs data can be compared with the

current percentage and any variation in the overhead can be seen. This variation from past data could indicate a need to further investigate the total overhead costs.

Table 3-1 describes the fields used to generate the Total Overhead/Total Cost percentage. This percentage is derived directly from the 7220.29-H data tape fields and can be compared to the Depot Maintenance Costs Statement, Table 2-2.

c. Non-Organic/Total Cost

Non-organic costs are costs which include non-depot maintenance costs, interservice costs and contract costs. This percentage calculation provides insight into the amount of non-depot work relative to the total cost a depot is performing during a reporting period. This calculation provides information both from a production standpoint and a cost and budget standpoint. At a glance, management can determine how much of the total costs are used for contracting, interservicing or non-depot.

The non-organic costs to total costs percentage was developed to help provide a picture of the depot operations not conducted by the depot itself. This percentage can readily be compared to the direct cost percentage. Also the relative size of the depot operation versus the non-organic operations can be compared. Table 3-1 describes this percentage and the fields associated in the 7220.29-H tapes.

d. Government-Furnished Materials and Support/
Total Cost

The percentage of the cost of government-furnished equipment and support of the total cost measures the cost contribution the government makes in materials and services to contracting, interservicing, and non-depot maintenance activities. This percentage describes the portion of total cost that is being used to support the non-organic maintenance effort. The percentage does not directly indicate any performance for the depot and cannot be used to describe rates of interservice, non-depot or contracting maintenance used. However, the government-furnished materials and services to total cost percentage does provide management with a convenient method to gauge the relative significance of the non-organic costs of the government to the depot production total cost. Government-furnished materials and support to total cost are derived from the 7220.29-H data tape fields as described in Table 3-1. This measure of materials and support cost has the advantage that it can be calculated directly from the 7220.29-H data tapes. Additionally, the Depot Maintenance Costs Statement, Table 2-2, and this ratio can be readily compared.

e. Service Costs/Total Cost

Service costs to total costs is a measure of the costs of the depots and individual service (i.e., Air Force, Army, Marines and Navy) to the total DoD depot costs. This

measure depicts how much each service is spending on depot maintenance relative to the other services.

Service costs and total service costs are derived from the 7220.29-H data tape fields as described in Table 3-1, summing the total costs for each service. These values are then compared to the total cost of all services to derive a percentage of the total.

C. TREND ANALYSES AND STATISTICS

Performance appraisal of production requires some standards for comparisons.

Management must take into account all the factors which could influence results, that the elements included must be standardized to eliminate differences arising from accounting judgments rather than from operating fact, and that costs not directly incurred by the divisions must be distributed in an equitable way.
[Ref. 9:pp. 151-152]

A trend line over several years calculated with ratios provides a means to estimate a standard of performance or base line that can be used for comparisons. This section suggests several trends and facility statistics that could be of use in understanding the performance of depot maintenance.

1. Total Cost by Service

This trend presents the total cost picture as a trend line covering five years including the most current year reported by the depots. It depicts the four major services' depot costs on the graph with time on the horizontal axis and cost on the vertical. Individual services could compare total

cost trends relative to the other services. However, direct comparisons between services on total cost dollar values should not be made because budgets and cost requirements are not the same between all services.

The Total Cost by Service trend is derived from the summation of total costs reported by depots in each service. These totals of the four services are then plotted against time for a trend.

2. Trends of Ratios

The ratios presented previously, in this chapter, are an attempt to depict depot operations. To make an analysis with these ratios complete, the time dimension must be introduced to develop a trend. Ratios selected for the trends depend upon what management must measure or compare. Their experience will dictate which ratios are most meaningful for this purpose.

3. Facility Performance Statistics

The Facility Performance Statistics table would consist of various costs and statistics for commodity groups. Tables 3-2 and 3-3 give examples of selected facility performance statistics that might be employed in such a display. The tables would relate to only one service and the largest dollar value commodity items for that service. This does not preclude the use of the tables to cover all DoD depots or individual depots top commodity items for the period in one table.

TABLE 3-2

FACILITY PERFORMANCE STATISTICS

COMMODITY GROUP	DIRECT COST	GOVT. FUR MATL & SERV	LABOR HOURS	OVERHEAD COST
AIRCRAFT	XXXXXX	XXXXXX	XXXXXX	XXXXXX
COMBAT VEH.	XXXXXX	XXXXXX	XXXXXX	XXXXXX
<u>SHIPS</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>
TOTAL	XXXXXX	XXXXXX	XXXXXX	XXXXXX

TABLE 3-3

FACILITY PERFORMANCE STATISTICS (RATIOS)

COMMODITY GROUP	DIR. COST/ LABOR HRS.	DIR. COST/ TOTAL COST	TOTAL OVHD/ TOTAL COST	GOVT. M&S/ TOTAL COST
AIRCRAFT	XXXXXX	XXXXXX	XXXXXX	XXXXXX
COMB. VH.	XXXXXX	XXXXXX	XXXXXX	XXXXXX
<u>SHIPS</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>	<u>XXXXXX</u>
TOTAL	XXXXXX	XXXXXX	XXXXXX	XXXXXX

The Facility Performance Statistics table could include many of the ratios and percentages already presented and could contain various tabulated data from Chapter II. Selected statistics might include for each commodity group, direct cost, overhead costs, non-organic maintenance costs, and Government-furnished materials and services costs. Ratios or percentages might include labor hours per commodity unit, work days in process per unit, and total cost per commodity. The statistics selected will be based on criteria discussed in the next chapter. Although not an all inclusive list, the statistics, provided in this chapter and the previous chapter are of value for analysis and for inclusion in the proposed annual reports.

The potential limitations inherent in ratio analysis cannot be overemphasized. Ratios are used principally for detecting significant changes or unusual relationships between financial statement items. They serve as signals of the need for further investigation. Particular caution must be exercised when comparing the size of a ratio with the corresponding ratio of an earlier period or with that of a similar firm in the same industry. Changed conditions or different operating environments may limit the comparability of the ratios in these and other cases. [Ref. 10:p. 206]

IV. DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

A. INTRODUCTION

The purpose of this research project is to develop a feedback mechanism in the form of an annual report supporting the DoD Instruction 7220.29-H. Methods of reporting financial and operational data have been explored with the goal of designing an annual report. Designing one annual report that would be of value to different groups, however, poses a significant challenge, whereas a report designed solely for one of these groups might not be of value to the other groups, as varying levels of specificity are required in the data presented. [Ref. 11:p. 180][Ref. 12:p. 43]

The development of one annual report must consider the information needs of the potential users. While there may be no distinct boundaries between various users and the reports that would be useful to them, groups of users can be identified such as management of the maintenance depots, military service headquarters and DoD staff, and government organizations external to DoD. Therefore, four distinct reports have been developed, one for each of the three groups and one generalized annual report. The remainder of this chapter is devoted to describing the proposed reports. The discussion references tables from Chapter II and ratios from Chapter III that would be useful in these annual reports.

Table 4-1 is a summary table of the ratios and tables identified in this thesis that are contained in the reports designed for the user groups discussed.

TABLE 4-1A
REPORT ANALYSIS CONTENTS

TABLE	<u>REPORT LEVEL</u>			
	DEPOT	SVC/DOD	OTHER GOVT.	ANNUAL
DEPOT MAINT. COST & LABOR HOUR STMT.	X	X	X	X
TOTAL COST BY FACILITY	X	X	X	X
SELECT COST BY ACTIVITY	X	X	X	
TOTAL COST BY COMMOD.	X		X	X
TOTAL ORGANIC COST BY COMMODITY		X	X	X
CONTRACT COST BY COMMODITY		X	X	X
COMMODITY MAINT. SUPP				X

TABLE 4-1B

REPORT ANALYSIS CONTENTS

RATIOS	<u>REPORT LEVEL</u>			
	DEPOT	SVC/DOD	OTHER GOVT.	ANNUAL
DIR. COST/ LABOR HRS.	X	X		
TOT. OVHD/ DIR. COST	X	X		
DIR. COST/ WORK DAYS IN PROCESS	X	X		
DIR. COST/ TOTAL COST	X			
TOTAL OVHD/ TOTAL COST	X			
NON-ORGANIC/ TOTAL COST	X			
GOVT. FUR. MTLS. & SUPP/ TOTAL COST	X			
MAINT SUPP/ TOTAL COST				
SERVICE COST/ TOTAL COST OF DOD DEPOT				
TOTAL COST/ SERVICE				
FACILITY PERFORM STATIST	X			

B. REPORT TO THE MANAGEMENT OF THE MAINTENANCE DEPOTS

Managers of maintenance depots have numerous concerns related to efficient production controls. One of these concerns is the control of costs, specifically, comparative cost controls. Information is needed for planning or assessing the ability to control costs and for "focusing attention on non-recurring or unforeseen problems that may arise" [Ref. 13: p. 78]. Depot management information systems are already providing timely and detailed information; a report designed for this level of overview would augment information already available. Therefore a report structure has been designed to provide additional cost and control data which may not be provided from existing systems. The proposed standard report would include the following statements:

- Depot Maintenance Cost and Labor Hour Statement
- Total Cost by Facility Type
- Selected Costs by Activity Type
- Total Costs by Commodity Group
- Depot Production and Cost Ratio Statement

1. Depot Maintenance Cost and Labor Hour Statement

The Depot Maintenance Costs and Labor Hour statement, described in Table 2-2, would be supplemented with Cost and Labor Hour statements from depots of a similar type for comparisons. This would provide the depot an indication of the actual costs and labor hours of the other depots compared to their own. A column of the previous year's figures would

provide prior year/present year comparison of costs and hours. Table 4-2 displays the proposed statement format. Alternatively, the statement could display a column of percentages of the total costs and hours together with the comparative data for costs and hours.

TABLE 4-2

DEPOT MAINTENANCE COSTS AND LABOR HOUR STATEMENT

	DEPOT-A		DEPOT-B	
	Current	Prev	Current	Prev
	Yr(\$)	Yr(\$)	Yr(\$)	Yr(\$)
DIRECT COSTS	xxxxxx	xxxxxx	xxxxxx	xxxxxx
TOTAL OVERHEAD COSTS	xxxxxx	xxxxxx	xxxxxx	xxxxxx
NON-ORGANIC MAINTENANCE COSTS:				
NON-DEPOT	xxxxxx	xxxxxx	xxxxxx	xxxxxx
CONTRACT	xxxxxx	xxxxxx	xxxxxx	xxxxxx
INTER-SERVICE	xxxxxx	xxxxxx	xxxxxx	xxxxxx
GOVERNMENT-FURNISHED MATERIALS	xxxxxx	xxxxxx	xxxxxx	xxxxxx
GOVERNMENT-FURNISHED SERVICES	xxxxxx	xxxxxx	xxxxxx	xxxxxx
MAINTENANCE SUPPORT COSTS	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>
TOTAL COSTS	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Direct Civilian Labor Hours:				
Production	xxxxxx	xxxxxx	xxxxxx	xxxxxx
Other	xxxxxx	xxxxxx	xxxxxx	xxxxxx
Direct Military Labor Hours:				
Production	xxxxxx	xxxxxx	xxxxxx	xxxxxx
Other	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>
Total	XXXXXX	XXXXXX	XXXXXX	XXXXXX
Work Days in Progress	xxxxxx	xxxxxx	xxxxxx	xxxxxx

2. Total Cost by Facility Type

The Total Cost by Facility Type statement, Table 2-3, could be used by maintenance depot management to review costs, by percentages, for the four facility types: depot, non-depot, contract and interservice. This table identifies the proportion of total costs that are allocated to the four facility types and what portion of each is internally funded or unfunded. This table enlarges the depot's base of data by including other depots' data so the cost of alternate repair capacity can be identified. Table 4-3 is a sample of this proposed format.

TABLE 4-3
TOTAL COST BY FACILITY TYPE

<u>FACILITY TYPE</u>	<u>FUNDED</u>	<u>UNFUNDED</u>	<u>TOTAL</u>
DEPOT MAINTENANCE	60%	40%	40%
NON-DEPOT MAINTENANCE	50%	50%	30%
CONTRACT	40%	60%	20%
INTERSERVICE	<u>20%</u>	<u>80%</u>	<u>10%</u>
TOTAL	75%	25%	100%

NOTE: Values are fictitious but would be total of all depots of a similar type.

3. Selected Costs by Activity Type

The Selected Costs by Activity Type statement, Table 2-4, represents labor hours and costs associated with organic

depot maintenance. This table would contain information on the depot to which the report was intended and would include data from other depots and other services, thereby augmenting the depot's comparative analysis capability. Table 4-4 is a sample of what the proposed table would contain.

TABLE 4-4
SELECTED COSTS BY ACTIVITY TYPE

ACTIVITY	LABOR HRS	DIR COSTS	MAINT SUP. COSTS	OVHD	TOTAL
Other	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
depots of	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
a like	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
<u>type</u>	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>	<u>xxxxxx</u>
TOTAL	XXXXXX	XXXXXX	XXXXXX	XXXXXX	XXXXXX

1. Total Costs by Commodity Group

The Total Cost by Commodity Group statement, Table 2-5, would be an amplification to depot level management's costs by facility type. It would provide an indication of how these costs are allocated within commodity groups across services. This table presents the data so that comparisons may be made within commodity groups of facility costs and their relationship to the commodity group total costs. Variation in commodity group costs as reported could be tracked by management over time. Given the table will include all services, only a limited number of the high dollar, high volume commodities would be displayed.

5. Depot Production and Cost Ratio Statement

The Depot Maintenance and Cost Ratio statement would include most all of these ratios discussed in Chapter III. The ratios, averages and trends identified contain the specific operating information that is useful at the operating level. [Ref. 14:p. 43] Table 4-5 provides a suggested presentation of the data. With the calculation of total cost proportions, a pie chart could easily be designed to indicate how the total costs are divided for the most recent reporting period.

TABLE 4-5

DEPOT PRODUCTION AND COST RATIO STATEMENT

RATIO	YEAR 5	YEAR 4	YEAR 3	YEAR 2	YEAR 1
DIR. COST/ LABOR HRS.	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
OVHD/DIR COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
DIR. COST/WORK DAYS IN PROCES.	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
DIR. COST/ TOTAL COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
TOTAL OVHD/ TOTAL COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
NON-DEPOT + CON- TRACT + INTERSERV/ TOTAL COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
GOVT. FUR. MTLs. & SUP/TOTAL COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
MAINT. SUPPORT/ TOTAL COST	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

C. REPORT TO MILITARY SERVICE HEADQUARTERS AND DOD STAFF

Military services' headquarters and DoD staffs are concerned with an overall view of the performance of depot types such as NARF's, ALC's, and shipyards rather than individual depots. Therefore one report would be prepared for each depot type grouping. Similar to the report designed for individual depots, the Service Headquarters/DoD level report would consist of several statements designed to provide comparative performance indicators.

Table 2-2, the Depot Maintenance Costs and Labor Hour statement, would summarize the proportionate costs and labor hours for a depot grouping. As shown in Table 4-6, prior year cost patterns would be compared to the report year results, providing information needed to assess the depot grouping's ability to meet cost objectives.

The Total Cost by Facility Type statement, Table 2-3, would depict costs of depot groupings relative to the Depot, Non-depot, Contract, and Interservice divisions, enabling the user to compare the amount of resources used for depot maintenance to the amount used for other types of maintenance. Table 2-4, Select Costs by Activity Type statement, would provide a comparison of all the groupings for a service. Relative growth comparisons in depot level maintenance can be observed if previous period data are consulted.

The Total Organic Costs by Commodity Groups statement, Table 2-6, would report selected costs of organic depots, by

TABLE 4-6

DEPOT MAINTENANCE COSTS AND LABOR HOUR STATEMENT

	Current Year (%)	Previous Year (%)
DIRECT COSTS	xxxxxx (x%)	xxxxx (x%)
TOTAL OVERHEAD COSTS	xxxxxx (x%)	xxxxx (x%)
NON-ORGANIC MAINTENANCE COSTS (field 36):		
NON-DEPOT (if field 7 = 2)	xxxxxx (x%)	xxxxx (x%)
CONTRACT (if field 7 = 3)	xxxxxx (x%)	xxxxx (x%)
INTER-SERVICE (if field 7 = 4)	xxxxxx (x%)	xxxxx (x%)
GOVERNMENT-FURNISHED MATERIALS	xxxxxx (x%)	xxxxx (x%)
GOVERNMENT-FURNISHED SERVICES	xxxxxx (x%)	xxxxx (x%)
MAINTENANCE SUPPORT COSTS	xxxxxx (x%)	xxxxx (x%)
TOTAL COSTS	XXXXXX (X%)	XXXXX (X%)

CURRENT YEAR DATA

Direct Civilian Labor Hours:		Total
Production	xxxxxx	
Other	xxxxxx	xxxxxx
Direct Military Labor Hours:		
Production	xxxxxx	
Other	xxxxxx	xxxxxx
Total		xxxxxx
Work Days in Progress		xxxxxx

service, to provide an indication of differences of cost in commodity areas for the depots. Depots with lower costs on specific commodity items might have additional quantities of

those items funneled to it after a detailed investigation indicates resource allocation is warranted.

Table 2-7, Contract Cost by Commodity Group for Select Depots, provides, by grouping, the contract costs for the reporting period. The select depots might include the services, ALC's, NARF's, or Shipyards, as well as identifying the four individual services totals as a separate table with total contract costs by commodity. OASD managers could see where indications of interservicing might take the place of contracting for certain commodities.

The ratio analysis discussed in the previous section would also apply to this level report except that ratios would be by depot grouping and military service instead of individual depots as shown in Table 4-5. This summary of data would provide an indicator of service and depot group performance. When the data are compared with previous periods, trends can be identified. Incorporated with this table could be a pie chart display of individual service depot costs to the total DoD depot costs. The Total Cost by Service statement, Table 3-2, would display the total cost picture as a trend covering five years for each service. This, coupled with other data, could be used to estimate future budgets for DoD and for a particular service.

The Facility Performance Statistics statement, Table 3-1, would contain data for each service, for grouped depots, and for DoD depots in total. This table would be useful in

indicating the cost of various commodity groups for the designated groupings in the table.

D. REPORT TO GOVERNMENT ORGANIZATIONS EXTERNAL TO DOD

Government organizations external to DoD who might be interested in a report on DoD depot maintenance include Congressional budget committees. A report to this user group would be more concise and include larger groupings of both depots and data than in the reports previously discussed. [Ref. 15:p. 543] Such a report would primarily contain consolidated data from each service or from DoD as a whole. For example, Table 2-2, the Depot Maintenance Costs and Labor Hour Statement, would contain the sum total of all services depots costs and labor hours for the reporting period. The Total Cost by Facility Type statement, Table 2-3, would report the total DoD costs for each of the four facility types of maintenance, thus providing information to help identify the cost of alternate repair capacity. The Select Costs by Activity Types statement, Table 2-4, would provide production costs by service instead of by activity type. When used with prior period reports, this data enables growth comparisons of depot maintenance for the services.

The Total Cost by Commodity Group, Table 2-5, provides the costs for the commodities among the various types of maintenance facilities. The cost would be totaled for all DoD as a whole. Comparisons of facility type costs and their

relationship to the commodity group total cost can be made within commodity groups. Over time, commodity groups can be tracked to see how costs vary on the DoD level. Table 2-6, the Total Organic Costs by Commodity Group statement, would provide cost values for each service with totals for each commodity item. The Contract Cost by Commodity Group statement would follow a similar format.

E. GENERAL ANNUAL REPORT

The annual report for DoD depot level maintenance would provide a general summary of the reporting period. Unlike previously discussed reports, the general annual report is designed for a more general audience as well as any of the previously identified level of users. For the content to be meaningful to a broad audience, the information provided must be highly generalized and summarized. [Ref. 16:p. 43]

The following discussion describes each of the sections of the report.

1. Objectives

The objectives section of the report is a statement of both mission and objectives of DoD depot level maintenance, what the tasks are, who is supported and who is responsible for the mission. This section gives the unfamiliar a good overview of what a depot does.

2. Highlights

The yearly highlights section of the report would include exhibits and/or narrative about the year's highest

volume/highest dollar value production items and their costs or percentage of total commodity costs. Additional narrative describes the depot system accomplishments and costs for the period and possible future trends. As an added highlight, each year the report could present in greater detail the specific capabilities and statistics of a selected weapons system, such as a new system brought into the DoD inventory during the report period.

3. Comparative Statements

The Comparative Statement section would display DoD depot total costs comparative financial statements, percentages, cost dollars, and labor hours for the past five years. Following this section, production and cost tables would be included. Of the various tables described in Chapters II and III, the following tables were selected because they contain information that is meaningful in a broad context. [Ref. 17: p. 42]

- Total Cost by Facility Type, Table 2-3, would list Facility types as shown in the table. Each service would be represented across the top as columns with the total.
- The Total Cost by Commodity Group, Table 2-5, would describe the cost of DoD depot maintenance for the period.
- Total Organic Costs by Commodity Group, Table 2-6, would present commodity group as in Table 2-5. The depots would be replaced with the services and a last column would be added to show the total for the commodity item.
- Contract Cost by Commodity Group, Table 2-7, would describe contract costs for repairable items at various depots. The costs by commodity would not

contain all commodities but instead might list only the three or five highest dollar value items.

- The last table is the Commodity Maintenance and Maintenance Support, Table 2-8, and could be either headed on top by service or as total DoD depot maintenance with the last five years displayed. The choice would depend upon how much information output is desired and how restricted are the amounts of output allowed to this report.

4. Ratio Analysis and Statistics

The Ratio Analysis and Statistics section would provide information using the ratios described in Chapter III. The trend data would be displayed showing historic total cost by service for depot maintenance over the last five years. Additionally, a pie chart describing the total costs by cost category would be provided along with a pie chart displaying total DoD depot costs divided by each service's total costs.

5. Summary

The annual report is designed to provide individuals a broader understanding of the depot organization. Further analysis of DoD depots is facilitated by the use of the ratios described in Table 3-1B, Facility Performance Statistics (Ratios), which would show commodity group ratios for all DoD depots.

F. CONCLUSIONS

While the analyses and reports suggested might not satisfy the precise needs of all individuals or organizations, the selection of the statements/tables and ratios was achieved through research and discussion with OASD personnel. The

unique selections represent the most widely used or needed data by the various management or oversight levels.

G. RECOMMENDATIONS

Based on the analysis and the conclusions, the following specific recommendations to improve OASD(A&L) reporting are provided:

1. Provide a report for the management of depot level maintenance that will link their management reporting to OASD reporting. This feedback system will enable both the depot and OASD to monitor how the reporting system is operating. A suggested format for the report has been described in this thesis.
2. Provide a second report developed for the military service headquarters and DoD. A suggested format for the report has been described in this thesis.
3. Compile a third report for management levels above OASD that would provide an overview of DoD depot maintenance costs. A suggested format for the report has been described in this thesis.
4. Make available for general overview an annual report of the DoD depot maintenance operations. This report would be the most widely circulated and consequently would have to be the most general. A suggested format for the report has been described in this thesis.

H. SUMMARY

This thesis has discussed several methods of combining data that DoD maintenance depots report to OASD(A&L) as directed by DoD Instruction 7220.29-H. Recommended formats such as data tables, cost statements, trends, charts, ratios and percentages were proposed. These were then combined to develop suggested reports that would be sent to various groups interested in depot maintenance. An annual report was also

designed that could be used as a general report of DoD depot maintenance.

APPENDIX

Military Service Depots annually submit data on completed job orders to the Department of Defense (DoD), as directed by DoD Instruction 7220.29-H. The Defense Manpower Data Center produces, on request, 14 different report tables from these data. This appendix describes these reports.

TABLE #	REPORT TITLE
1	TOTAL DEPOT MAINTENANCE COST (\$000)
2	COST BY PROGRAM ELEMENT AND COMMODITY (\$000)
3	COST BY FACILITY TYPE AND COMMODITY (\$000)
3A	COST BY FACILITY TYPE AND COMMODITY DEPOT MAINTENANCE WORK PERFORMANCE CATEGORIES (\$000)
3B	COST BY FACILITY TYPE AND COMMODITY MAINTENANCE SUPPORT WORK PERFORMANCE CATEGORIES (\$000)
4	SELECTED FACILITY PERFORMANCE STATISTICS
5	COST BY FACILITY AND COMMODITY (\$000)
6	COST BREAKDOWN BY ORGANIC DEPOT MAINTENANCE ACTIVITIES (\$000)
7	COST BREAKDOWN BY ORGANIC NON-DEPOT MAINTENANCE ACTIVITIES (\$000)
8	COST BREAKDOWN BY CONTRACT ACTIVITIES (\$000)
9	COST BREAKDOWN BY INTERSERVICE ACTIVITIES (\$000)
10	TOTAL COST BY WEAPON SYSTEM AND DEPOT MAINTENANCE WORK PERFORMANCE CATEGORIES (\$000)
11	TOTAL COST BY WEAPON SYSTEM AND MAINTENANCE SUPPORT WORK PERFORMANCE CATEGORIES (\$000)

- 12 ITEMS MAINTAINED IN EXCESS OF 100% OF STANDARD INVENTORY PRICE BY FACILITY (total excess greater than \$10,000)
- 13 TOTAL COST BY WEAPON SYSTEM AND WORK BREAKDOWN STRUCTURE (\$000)--(DEPOT MAINTENANCE WORK PERFORMANCE CATEGORIES)
- 14 ITEMS REPAIRED AT MORE THAN ONE FACILITY; CRITERION. PRODUCTION QUANTITY $\times$ TOTAL COST GREATER THAN OR EQUAL TO \$50,000

There are fourteen data tables generated from the data submitted by each Service, reflecting that Service's depot maintenance and maintenance support efforts. Some of these tables reflect total costs and production efforts while others provide information on individual facility costs and production. Significantly, many of these tables provide cost and production information at the weapon system or support system, end item, and component level. The fourteen Service tables are discussed in the following paragraphs.

TABLE 1

Table 1 displays total maintenance costs, including maintenance support. The breakout of costs for this table is at the major commodity level (e.g., aircraft, missiles, ships). The table further breaks down commodity group costs to those costs borne by the depot industrial funds of the Services (funded costs) and to those costs provided for, through, other appropriations such as military labor, modification kits, and exchange items (unfunded costs); both funded and unfunded costs involve labor, material, overhead, and G&A, among other costs.

Commodity group is determined by the first position of the Work Breakdown Structure Code field (position 79; field 13). The funded and unfunded columns are determined as follows:

Funded = Fields 17+19+21+23+25+30+32+34+36+41+43

Unfunded = Fields 26+27+28+29+31+33+35+37+38+39+40
+ 42+44

Total = funded and unfunded (sum of preceding two columns)

TABLE 2

Table 2 depicts costs by major commodity group within the different program elements used to pay for depot maintenance and maintenance support. Again, both funded and unfunded costs are identified.

Commodity group and funded/unfunded are determined as described in Table 1. Program element is determined from positions 5-9 (field 4).

TABLES 3, 3A, and 3B

Table 3 identifies total costs by facility type within the major commodity groups, also showing the funded and unfunded portions of these costs. Tables 3A and 3B subdivide Table 3 into the costs of depot maintenance and maintenance support, respectively.

Facility types 1, 2, 3, and 4 are defined as codes 1, 2, 3, and 4, respectively, in field 7 (Owner/Operator Code). Commodity group and funded/unfunded are defined as in Table 1.

Table 3A, covering depot maintenance work, only, is limited to cases in which Work Performance Category (WPC), position 82 (field 14), is coded A through N; Table 3B, covering maintenance support work, is limited to cases with WPCs of P, Q, R, S, or T.

TABLE 4

Table 4 provides performance statistics on selected Type 1 Facility (organic depot maintenance activities) performance within the Service being reported on. The following statistics are generated for each facility selected:

A. Total Cost = Fields 17+19+21+23+25

B. Percent of Total Cost that is Funded =

$$\frac{\text{Fields 17+19+21+23+25+30+32+34+43}}{\text{Fields 17+19+21+23+25 to 44}}$$

C. Civilian Labor Cost Per Hour = $\frac{\text{Fields 17+19}}{\text{Fields 18+20}}$

D. Material Cost Per Labor Hour = $\frac{\text{Fields 25+26+27+28+29}}{\text{Fields 18+20+22+24}}$

E. Productive Indirect Costs Per Labor Hour =

$$\frac{\text{Fields 32+33}}{\text{Fields 18+20+22+24}}$$

F. General and Administrative Costs Per Labor Hour =

$$\frac{\text{Fields 34+35}}{\text{Fields 18+20+22+24}}$$

G. Direct Material Cost to Direct Labor Cost Ratio =

$$\frac{\text{Fields 25+26+27+28+29}}{\text{Fields 17+19+21+23}}$$

H. Productive Indirect Costs (Operations Overhead) to
Direct Labor Cost Ratio =

$$\frac{\text{Fields } 32+33}{\text{Fields } 17+19+21+23}$$

I. General and Administrative Expense to Direct Labor
Cost Ratio =

$$\frac{\text{Fields } 34+35}{\text{Fields } 17+19+21+23}$$

TABLE 5

Table 5 displays costs (funded and unfunded) by facility, within the four facility types, and by major commodity groups. Facility, facility type, and major commodity group are defined as in previous tables.

TABLE 6

Table 6 structures and portrays the costs incurred at organic depot maintenance activities (field 7, Owner/Operator Code, is equal to 1). It also identifies the total labor hours expended at each organic activity. As in previous tables, facility name is determined from field 5.

The figures in the hour and cost columns are computed as follows:

$$\text{Labor Hours} = \text{Fields } 18+20+22+24$$

$$\text{Direct Labor Cost} = \text{Fields } 17+19+21+23$$

$$\text{Direct Material Cost} = \text{Fields } 25+26+27+28+29$$

$$\text{Other Direct Cost} = \text{Fields } 30+31$$

Maintenance Support Cost = Fields 32+33

Production Indirect Cost = Fields 32+33

G&A (General & Administrative) Cost = Fields 34+35

Total Cost = Fields 17+19+21+23+25 to 35+43+44
(sum of preceding six columns)

TABLES 7, 8, and 9

Tables 7, 8, and 9 provide cost breakdowns for activities other than organic depot maintenance. Table 7 reports on organic non-depot maintenance activities (field 7, Owner/Operator Code, is equal to 2), while Tables 8 and 9 cover contractor (code 3) and interservice (code 4), respectively. Facility name or code again comes from field 5.

The cost figures in the columns are defined as follows:

Contract = Field 36

GF (Government Furnished) Material = Fields 37+38+39+40

Government Furnished Service = Fields 41+42

Maintenance Support = Fields 43+44

Total = Fields 36+37+38+39+40+41+42+43+44
(sum of preceding columns)

TABLES 10 and 11

Tables 10 and 11 provide the first look at cost by end item, identifying individual weapon and support system costs

by commodity (as defined in previous tables) and work performance categories (position 82). The costs (funded and unfunded) reflected in Table 10 include WPCs other than those accounting for maintenance support works (i.e., codes A through N in position 82 are included). Table 11 is limited to maintenance support WPCs (codes P, Q, R, S, T). The first column in the tables, a code identifying the individual system, is determined by the Weapon or Support System Code (field 12); a conversion list must be used to generate a name for the system.

TABLE 12

Table 12 identifies work done, by item nomenclature (field 10) and identification number (field 9)--often the FSC or FSN--where the average unit cost expended for maintenance exceeded the inventory or stock list price carried in official records. The items are aggregated by facility (field 5) performing the work or giving the support. Also displayed are WPC, Weapon/Support System Code, and Commodity. Table 12 reflects only those items for which the total excess costs were greater than \$10,000.

The monetary and quantitative categories indicated in the column headings are defined as follows:

$$\begin{aligned} \text{Total Excess} &= (\text{Average Maintenance Cost minus SIP}) \\ &\times \text{Production Quantity} \end{aligned}$$

$$\text{Standard Inventory Price} = \text{SIP (Positions 65-74)}$$

Average Maintenance Cost = $\frac{\text{Fields 17+19+21+23+25 to 35}}{\text{Field 45}}$

Production Quantity = Field 45

Average Work Days = Field 50

TABLE 13

Table 13 returns to weapon and support system analysis. Costs (funded and unfunded) accumulated and displayed include all WPCs other than maintenance support WPCs (include codes A through N in position 82) and are distributed by commodity (as defined previously) and by position 81 of work breakdown structure code, which specifies the component of the system on which maintenance was performed. In this table the WSSC is converted to the correct nomenclature of the actual weapon or support system and reflected in the first column of the table.

TABLE 14

Table 14 identifies items repaired at more than one facility. Specifically, each grouping of rows consists of cases where a unique combination of Item ID (field 9), Item Name (field 10), Work Breakdown Structure Code (field 13) and Work Performance Category (field 14) occurs at more than one Performing (field 5) or Reporting Facility (conversion of field 8). This table includes only workloads having total costs (quantity × unit costs) in excess of \$50,000.

The quantitative columns in the table are determined as follows:

Quantity completed = Field 45

Total Cost = Fields 17+19+23+25 to 44

Maintenance Cost/Unit = $\frac{\text{Fields 17+19+23+25 to 44}}{\text{Field 45}}$

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